ONTARIO FOOD PROCESSING

RESEARCH & SERVICES COMMITTEE

2001 ANNUAL REPORT

TO

ONTARIO AGRICULTURAL SERVICES COORDINATING COMMITTEE

February 2002

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I. EXECUTIVE SUMMARY

The Ontario Food Processing Research and Services Committee (OFPRSC) has a mandate to identify and prioritize food research and non-research needs to facilitate the effective conduct of publicly funded food R& D and services.

In 2001, the focus of the OFPRSC annual meeting was to review initiatives undertaken in the last year and determine how the priorities and recommendations listed in the *OFPRSC 2000 Report* were being addressed. The committee also reviewed and updated the priorities and recommendations. Two Expert Sub-Committees communicated by email/teleconference during 2000 and contributed to the discussion of priorities and recommendations.

Ontario's food processing and agricultural sector continues to be one of the largest and most diversified in North America. Over 103,500 people are employed in Ontario's food, beverage and tobacco sector. The total value of shipments in 2001 was $29.1 billion. The food and beverage sector is fourth in terms of its contribution to the Ontario economy.

In 2001, the Food Research Program, funded through the OMAFRA/University of Guelph Enhanced Partnership Agreement, provided support for twenty-five research projects, including three new ones. The focus of the research is food safety and quality; value-added components in Ontario-grown foods; and innovative technologies to manufacture new food products. The program addresses several OFPRSC priorities, as well as those from the Ontario Food Engineering Research and Services Committee.

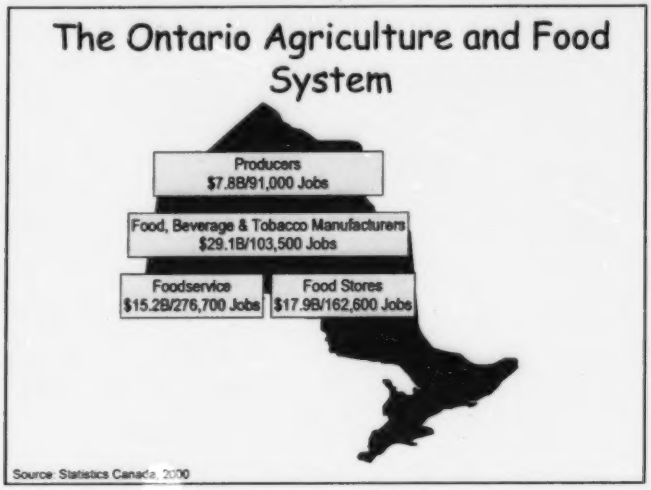
The Ontario Food Processing and Research Committee's priorities and recommendations continue to be addressed though OMAFRA's Special Research/New Directions Research Program; and the Food Safety Research Program. In 2001, the Government of Ontario invested $1.7 million in 13 food safety research projects addressing risk assessment, risk management and control, and test method development/validation. Through the Special Research Program, fourteen research projects which address priority areas of new value-added food and non-food, antimicrobial resistance and food safety risk assessment and risk control were also funded.

The OFPRSC reviewed the research priorities and recommendations included in the *OFPRSC 2000 Report* and determined that they are still appropriate and relevant. A new recommendation addressing biosecurity was added to the Non-Research Priorities for 2001.

II. FOOD INDUSTRY SECTOR SCAN

Food Industry Statistics for 2001

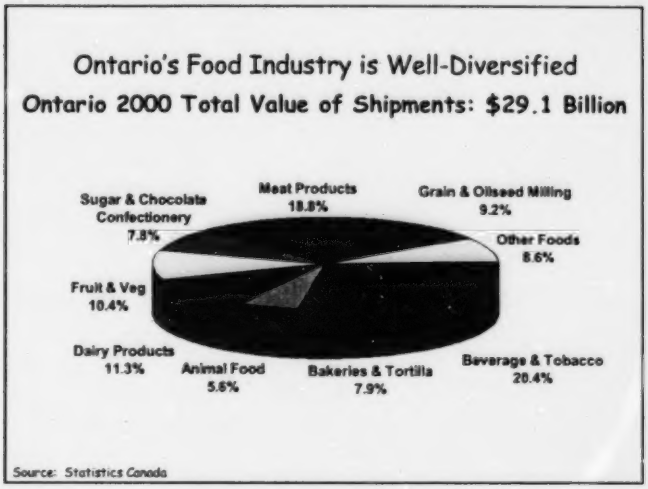
The Ontario food processing industry is a vital part of Ontario and Canada's economy. Ontario food, beverage and tobacco processors provide 103,500 (updated) jobs while the food service and retail food sale sectors combined for over 439,300 (updated) jobs.



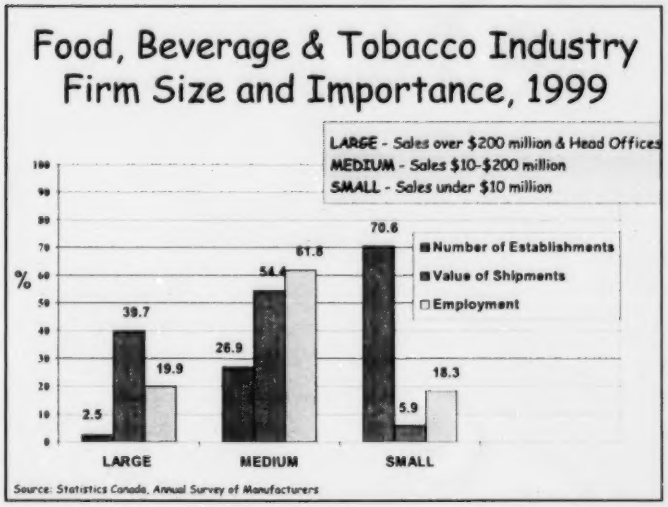
The Ontario food and beverage sector is fourth behind transportation equipment, electrical and electronic products and primary metal and fabricated metal products in terms of its contribution to the Ontario economy.

- GDP from food, beverage and tobacco industries is 11.2% of that from all manufacturing industries in Ontario.
- Ontario generates 46% of the GDP of the total food, beverage and tobacco industry in Canada.
- In 2001, $827M was invested in Ontario's food industry. This is an increase of 7% versus 2000 capital investment.

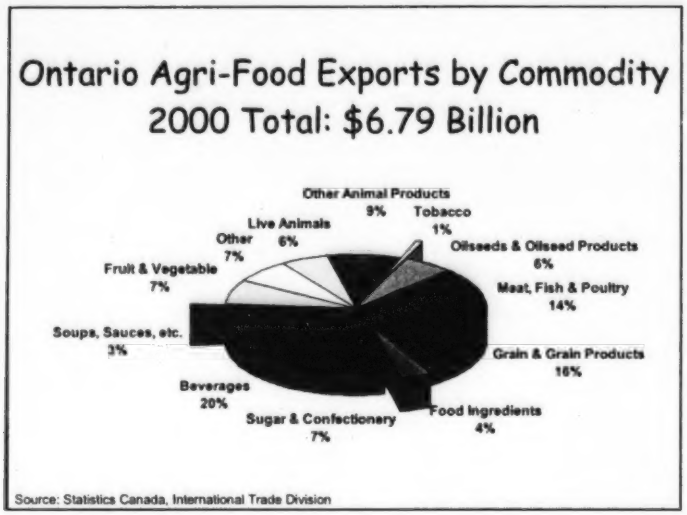
The total value of shipments from the Ontario food industry in 2000 was 29.1 billion dollars. Beverage and tobacco accounts for the largest value of shipments (20.4%), followed by meat products (18.8%), dairy products (11.3%), fruit and vegetables (10.4%), grain and oilseed milling (9.2%) bakeries and tortilla (7.9%) and sugar and chocolate confectionery (7.8%).


Ontario's Food Industry is Well-Diversified
Ontario 2000 Total Value of Shipments: $29.1 Billion
Meat Products 18.8%
Grain & Oilseed Milling 9.2%
Sugar & Chocolate Confectionery 7.8%
Other Foods 8.6%
Fruit & Veg 10.4%
Dairy Products 11.3%
Animal Food 5.6%
Bakeries & Tortilla 7.9%
Beverage & Tobacco 20.4%
Source: Statistics Canada

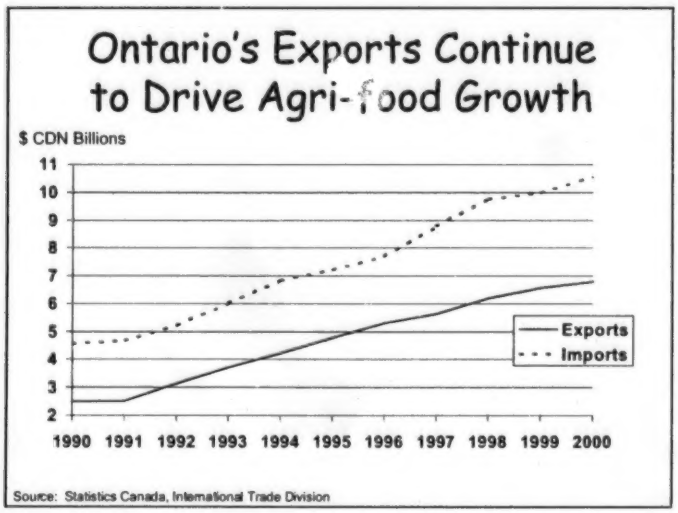
In 1999, approximately 54% of the value of shipments in Ontario was done by medium sized industry firms (firms with annual sales between $10-200 million), as compared to large sized firms with approximately 40% of the value of shipments and small firms with less than 6%.



2000 Ontario agri-food exports totaled $6.79 billion. Eighty percent of all exports are now value-added, a figure which has increased substantially over the last few years.



The dollar value of Ontario exports has shown steady growth over the past 10 years but at the same time the value of imports has also increased at a similar rate.



Major Events/Trends in the Food Industry in 2001

Much has occurred during calendar year 2001 that has the potential to impact on the food processing sector either directly or indirectly. Food safety, biosecurity and access to the US market are the major areas impacted. A summary of events follows:

- The Walkerton enquiry and its reports have raised concerns about water quality in the province.
- The terrorist attacks on the World Trade Centre have increased concerns about national security, personal security, civil liberties, boarder issues and access to the US market. As a result many organizations have issued guidance documents for food companies on evaluating and improving biosecurity at plant level. OMAFRA worked with the Guelph Food Technology Centre on a security checklist, which has been mailed to every company in the OMAFRA database. The checklist and a background piece have been posted to www.gov.on.ca/OMAFRA/.
- In Europe, especially the UK, the outbreak of foot and mouth disease and the ongoing issue of mad cow disease have had an enormous, direct economic impact. Further, these issues have eroded public confidence in both government and industry.
- The Ontario Auditor General's report made widely reported comments on meat inspection.
- In 2001 the Ontario government passed the Food Safety and Quality Act.
- Health Canada has gone to public consultation on nutrition labeling, health claims and nutrient content claims. Regulations are expected to be finalized mid 2002. Considerable effort will be required by industry to collect the necessary data and reprint labels. If the US during the early 1990's is a model in terms of complying with the National Labelling and Education Act, we can expect companies to divert research and product development budgets into nutritional labelling compliance over the next two years.
- Waste Diversion Ontario has been set up, to develop waste diversion programs for wastes designated by regulation. Industry funding organizations will be set up. Companies will be required to belong to an industry funding organization or to develop their own approved plan.
- The life science economy has become a major policy direction for both the federal and provincial governments.
- An overall economic downturn occurred during 2001. Recovery is expected during the second half of 2002. The food processing sector seems to have been less severely impacted than other sectors of the economy.
- The food biotechnology controversy has been less evident in the press during the past year. However there were a number of events which occurred on the food biotechnology front: Canadian Biotechnology Advisory Committee report, the Royal Society of Canada report, the

federal response to CBAC and the issuance of a draft voluntary labelling standard by the Canadian General Standards Board.

The Canadian General Standards Board issued a voting draft labelling standard to committee members in December. Written ballots were submitted during January 2002. A majority of members supported the draft standard but consensus was not achieved. The process will continue.

Economic Outlook

Economic growth in all major economies slowed sharply in the first half of 2001 and continued throughout the year. Weakness in the U.S. economy is expected through the first half of 2002, followed by a rebound in the second half of the year. There remains some question as to the rate of recovery to be expected. The U.S. economy is expected to lead the world economy in recovery. Signs in January now indicate that the US economy may have already gone into recovery. A report from the United States Department of Commerce states that, based on its data, Real Gross Domestic Product in the 4th quarter of 2001 increased at an annual rate of 0.2%.[1]

The Canadian economy, as it normally does, followed the U.S. lead into recession in 2001. While is not yet clear if the Canadian economy is technically in recession, evidence continues to mount. With this in mind, forecasters anticipate growth in national Gross Domestic Product (GDP) to be 1.3% in 2001, down from 4.4% in 2000. In 2002, the predicted growth is 1.1%, but resurgence in consumer confidence and export market is expected to improve growth in the second half of 2002. However as noted, with signs of recovery already evident in the United States, it remains to be seen whether revisions of these estimates will occur in the near future. Canadian job numbers for January, 2002 from Statistics Canada support this possibility.

Generally, it should be noted that the Canadian economy entered this economic downturn in much healthier condition than in recessions of the recent past. Compared to the recession of the early 1990's, the economic environment in Canada entering the current economic downturn differs in the following manner[2]:

- Interest rates are significantly lower (overnight rates peaked in early 1990's at 11% vs. 5% in 2000).
- Unemployment rates, while inching upward, are not expected increase much beyond 8% this time versus the double-digit rates of the early 1990's.
- Large fiscal deficits both federally and provincially restricted government actions and, in many respects, countered economic recovery.

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[1] Bureau of Economic Analysis. "Gross Domestic Product: Fourth Quarter 2001 (Advance)". United States Department of Commerce. Press Release Dated January 30, 2002.
[2] Holt, Derek.. Current Analysis (Toronto: RBC Financial Group, December 2001).

- The real estate market has been more controlled this time around compared to the collapse in real estate prices experienced in the early 1990's. While equity markets have shown sharp declines in 2001, they tend to be less leveraged and do not represent the significant position held by household mortgages in the typical consumer's household budget.
- Energy prices soared in the early 1990's. They have yet to do so this time round but could do so yet.

The Ontario economy faced serious threat this year because of a severe recession in its large manufacturing sector. The manufacturing sector comprises almost one quarter of its GDP. Ontario's manufacturing sector is expected to stabilize in the early part of 2002 and then recover later in the year. A consensus of private-sector forecasters anticipate that economic growth will be 1.1% in 2001 and 1.3% in 2002, respectively, compared to the original predictions of 2.3% and 3.6%. Forecasters also expect Ontario's growth to pick up in mid-2002 and accelerate to 4.3 percent in 2003. It should also be noted that the province still anticipates a balanced budget for fiscal 2001–2002.

If the increasing positive economic news from the United States continues, it is expected that further revisions will be made to Canadian economic estimates for 2002 and 2003. Since Ontario's economy is closely tied to the United States economy, it would benefit significantly from an earlier than expected American economic recovery.

The Canadian Food Industry and Business Cost

The Canadian food industry is especially impacted by the global economy as a large number of operating food processors are foreign owned. Furthermore, the growth of the Canadian agri-food industry is heavily dependent on increased trade and investment. With a more liberalised trade environment, the competitiveness of the Canadian and Ontario food industry is continuously scrutinised and must face this challenge if it is to retain and attract investment.

In terms of cost of operations, the analysis by consulting firm KPMG, *Competitive Alternatives: Comparing Business Costs in North America, Europe and Japan*, concludes the costs for Canadian-based food processors are 7.5 per cent less than those in the U.S., confirming Canada as an ideal investment location. In the food-processing sector, Canada ranked first in North America and fourth overall, closely following the United Kingdom, Italy and the Netherlands. Canada is also the overall cost leader in terms of laboratory research and development, with a cost advantage of 27.2 per cent over the U.S. While this is a significant advantage, it is exchange rate dependent and other natural advantages need to be exploited in order to remain competitive.

III. ACTIONS TAKEN SINCE 2000 REPORT

The OFPRSC held its annual meeting in December, 2001. The purpose of the meeting was to review new and existing food research initiatives and determine how the priorities set by the OFPRSC in 1999/2000 are being addressed. The priorities were also reviewed to determine if there were emerging issues that need to be addressed.

Two Expert Sub-Committees, Meat and Meat Products, and Cereal Grains and Oilseeds Products and Processing, communicated by email/teleconference during the year to review their priorities. The Expert Sub-Committee on Fruits and Vegetables plan to meet in June 2002. The Expert Sub-Committee on Dairy Products is still not active. The Expert Sub-Committee chairs attended the OFPRSC annual meeting.

The following food research initiatives were discussed by the OFPRSC.

OMAFRA/University of Guelph – Food Research Program

The OMAFRA/University of Guelph Food Research Program (2000-2004) is in its second year of a four year program. In 2001, twenty-three projects were supported in the following priority areas: food quality and safety (45%), value-added products (25%) and innovative technologies, processes and systems (30%). Three new projects were added to the program in 2001:

- Structure-Functional Studies of Phosphopeptides Derived from Egg Yolk Phosvitin as Nutraceuticals. This two year project is led by Yoshinori Mine.
- Modelling of Lycopene Extraction from Tomato in Supercritical CO_2 Fluid Extraction by Conventional and Soft Computing Approaches. This two year project is led by simon Yang.
- Controlled Atmosphere Storage and Modified Atmosphere Packaging of Fruits. This is a four project led by George Chu.

A complete listing of all the projects funded through the Food Research Program, including how they relate to the priorities identified by OFPRSC, is listed in APPENDIX C.

Several other research initiatives that are closely linked to the Food Research Program were also reported on at the annual meeting. These include:

- Professor Alejandro Marangoni from the Department of Food Science has been awarded a Canada Research Chair in Food and Soft Materials.
- The Emerging Materials Network was recently supported by a $7 million grant from the Ontario Research and Development Challenge Fund. The network is a program designed to create a network of university researchers and industrial intra/entrepreneurs dedicated to realizing the commercial potential of emerging materials. Emerging materials are those for which basic property values have been described, but which have yet

to achieve any significant commercial application. It includes nine universities (Carleton, Guelph, McMaster, Ottawa, Queen I S I Toronto, Waterloo, Western Ontario, and Windsor).

- The renovations to the new home of the Canadian Research Institute for Food Safety (CRIFS) are nearing completion. The new location for CRIFS is 93 McGilvary Street (former location of AAFC) at the University of Guelph.
- A group of scientists from the University of Guelph, Health Canada, AAFC, OMAFRA and Brock University have been awarded an NSERC Strategic Grant of $535,000 for three years. The grant is entitled " Microbial Food Safety – Integrated Modelling Techniques for "Farm-to-Fork" Risk Assessment. The grant will enable researchers to investigate:
  - Molecular-based models for the survival of food pathogens.
  - Models for population dynamics of foodborne infections.
  - Integration of quantitative and qualificative approaches for microbial risk assessment.

Five projects will be completed in the Food Research Program in 2002. A Call for Proposals will be issued to researchers in December 2001. In February, 2002, annual and final reports for ongoing projects will be reviewed. New proposals will also be assessed for funding in 2002.

The Food Research Program is funded through the five year Enhanced Partnership Agreement put in place in April, 1997 by OMAFRA and the University of Guelph. The first five year term of the partnership concludes on March 31, 2002. A new agreement must be in place in order for the university to continue to provide services to the Ministry in the areas of research, laboratory diagnostics and agri-food education.

In the final year of the agreement , the Ministry began a review of the partnership as an alternative service delivery mechanism. The review concluded the partnership has been a success, although there are areas that need improvement. Issues identified that must be addressed in the new agreement include more accountability, flexibility, and sustainability. The Ministry has been working closely with the university in the preparation of the proposed new directions for the new agreement.

OMAFRA Special Research/New Directions Research Program

The Special Research Program, funded by OMAFRA, is a $1.2 million matching fund designed to increase the competitiveness and sustainability of Ontario's agri-food sectors. OASCC priorities are used to help develop priorities for the fund on an annual basis.

In 2001, thirty-three research projects were funded in the following areas:

1.Ne w value-added food (nutraceuticals and functional food) and non-food products from Ontario agricultural raw materials – 8 projects funded;

2.Alter native livestock species in Ontario – 2 projects funded;
3.Antim icrobial resistance – 4 projects funded;
4.Food safe ty risk assessment and risk control – 2 projects funded;
5.A he althy environment – 8 projects funded; and
6.Pesticide re duction and safe usage – 9 projects funded.

A list of the project titles and researchers is provided in APPENDIX D. Additional details can be found on the OMAFRA website at: www.gov.on.ca/omafra/research.

For 2002, the Special Research Program has been revised. The name has been changed to better reflect the intent of the research program: New Directions in Agri-Food and Rural Research Program. The maximum funding per project has been increased to $100,000. The value-added food priority area continues to be included as a research priority through this program. The Call for Proposals can be found at: www.gov.on.ca/omafra/research. Funding decisions will be announced in April, 2002.

Ontario's Food Safety Research Program

Over the past two years OMAFRA, the Ministry of Health and Long-term Care and the Ministry of Natural Resources has gone through a review process of the food safety system in Ontario. The purpose of the review is to modernize and enhance Ontario's food sfaety system by increasing the government's capacity to:

- Protect public health;
- Maintain high standards of food safety; and
- Increase the marketability of Ontario food products.

The Food Safety Research Program was initiated as part of this review. It is a four year, four million dollar competitive program launched in February, 2001. Its purpose is to fund research to address the need: to analyze emerging hazards and contaminants; to develop/validate testing methods; and to contribute to risk assessment, control and management. The Innovation and Risk Management Branch of OMAFRA administers the program by issuing a Research Requirements Document; completing an expert review of proposals; and contract administration. Recommendations from OASCC committees, including OFPRSC, were used to help establish the priority areas of the program.

In 2001, there were two rounds of funding competitions, with $1.7 million awarded to thirteen projects. A list of the projects and researchers/institutions is provided in APPENDIX E.

IV. RESEARCH AND DEVELOPMENT PRIORITIES FOR 2001

At the OFPRSC 2001 Annual Meeting, the members reviewed the priority areas of research and determined them to still be appropriate and relevant. As in 1999 and 2000, the OFPRSC did not rank these priority areas during their annual meeting, but retained the listing in an order that reflects the rankings of the subcommittees. The complete lists of priorities for the subcommittees can be found in the subcommittee reports of the 1999 Strategic Report for 2000-2004.

1. Food Quality & Safety

Methods for early detection, and reduction/elimination of food safety hazards/contaminants:

- Improvement of quality and safety of minimally processed fruits and vegetables and development of protocols for early detection of pathogens and spoilage (Fruit and Vegetable Products and Processing #1a)
- Investigation of process techniques for reduction or elimination of deoxynivalenol (DON, vomitoxin), zearalenone, fumonisins and other mycotoxin components in cereal grains grown in Ontario. (Cereal Grain and Oilseed Products and Processing #2)
- Development of rapid, reproducible methods for detection and quantification of pathogenic *Campylobacter* in meat and poultry. (Meat Products and Processing #2)
- Development of efficient protocols for destruction of pathogens in fruits and vegetables (Fruit and Vegetable Products and Processing #2a)
- Identification and evaluation of intervention strategies for the destruction of pathogenic organisms in meat and meat products. (Meat Products and Processing #3)
- Development of procedure for *E.coli 0157:H7* reduction in uncooked fermented sausages and other ready-to-eat meat products (Meat Products and Processing #4)

"Farm to Fork" processes for ensuring food safety:

- Development of a risk assessment unit and tools to measure microbial risk assessment. (Meat Products and Processing #1)
- Development of methods to evaluate the effectiveness of HACCP programs at all levels (producer, processor, distributor and retailer) (Meat Products and Processing #5)

Methods to improve the quality and consumer acceptance of Ontario products:

- Improvement of the storage, processing and nutritional qualities of fruits and vegetables. (Fruit and Vegetable Products and Processing #1a)
- Investigation of alternatives to the use of chemical improvers in milling and bakery products (Cereal Grains and Oilseed Products and Processing #3)

On-line methods for monitoring and predicting quality during processing:

- Development of efficient on-line monitoring procedures for the safety and quality of raw produce and processed products (Fruit and Vegetable Products and Processing #2a)
- Development of on-line methods and technologies for monitoring product quality throughout milling and baking process (Cereal Grain and Oilseed Products and Processing #4)
- Development of rapid, on-line methodology for prediction of carcass end quality (Meat Products and Processing #7)

2. Value-added Products and Innovative Technologies

Methods to enhance the value of Ontario products:

- Isolation of value-added natural constituents from Ontario grown oilseeds and cereals and to improve the value of the products produced (Cereal Grain and Oilseed Products and Processing #1)
- Increase the levels of functional food ingredients/nutraceuticals in fruits and vegetables and to achieve increased understanding of their role in human health. (Fruit and Vegetable Products and Processing #1b)
    - Exploration of the potential for the development of novel health food products and cosmoceutical products from fruits, vegetables and the waste water generated during processing. (Fruit and Vegetable Products and Processing #1b)
    - Exploration of the application of biotechnology in improving fruit and vegetable production (Fruit and Vegetable Products and Processing #2b)

Development of innovative technologies to improve the manufacturing effectiveness of existing food products or to facilitate the production of new food products.

- Development of technologies to increase the efficiency of processing and automation of the fruit and vegetable processing industry. (Fruit and Vegetable Products and Processing #2a)
- Development and evaluation of processing technologies that will limit the impact of the processing industry on the environment without unduly affecting cost and competitiveness. (Cereal Grain and Oilseed Products and Processing #6)
- Investigation of dry milling and heat processing techniques for pulses and legumes to develop flours and meals for products currently imported into Ontario. (Cereal Grains and Oilseeds Products and Processing #6)

V. NON - RESEARCH PRIORITIES for 2001

OFPRSC supports the production of safe, quality food from a sustained environment irrespective of the technologies used. The Committee also supports consumer choice and the availability of comprehensive, unbiased information to encourage informed food purchasing decisions. The Committee recognizes the benefits of biotechnology, including safe quality food, improved nutrition, increased agri-food industry productivity, and improved environmental stewardship and advances in the production of pharmaceuticals. OFPRSC supports the use of science to minimize any possible risks associated with new technology. To this end, the Committee supports a strong food regulatory system and encourages the continued rigorous efforts of federal agencies to ensure food safety.

Biosecurity

The Ontario Food Processing Research and Services Committee, at its annual meeting in December 2001, expressed the view that priority should be given to ongoing industry and consumer education on what biosecurity is and why it is important. The objective is enhanced consumer confidence.

The events of 2001 have had an impact on public confidence in the food supply. The September 11 attacks on the World Trade Center, the anthrax problem in the US, the Walkerton enquiry, the foot and mouth disease epidemic in Europe and the BSE issue in the UK and elsewhere have elevated security concerns within the food sector.

In response numerous government organizations have issued recommendations to industry on evaluating the security of plant and distribution operations. Examples are CFIA and FDA. Several private sector organizations have also issued guidance documents to their members.

In response to this priority and to other inputs OMAFRA worked with the Guelph Food Technology Centre to develop a checklist on evaluating food safety and security at plant level. This document was mailed to 3000 food businesses and associations in Ontario. It has also been posted to the OMAFRA website (www.gov.on.ca/OMAFRA/). Further, a more detailed background piece was developed and posted to the OMAFRA website.

Consumer Education

Increased effort toward a consumer education strategy (including high school level) around safety and quality of Ontario grown and processed foods.

- Development of a consumer education strategy regarding food safety issues as a food safety intervention. (Meat Products and Processing)
- Greater effort is put into consumer education regarding the quality and safety of processed cereal grain and oilseed products. (Cereal Grain and Oilseed Products and Processing)

APPENDIX A: Ontario Food Processing Research And Services Committee Membership 2001

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APPENDIX B: OFPRSC Expert Sub-Committee Chairs - 2001

Ontario Expert Sub-Committee on Cereal Grains and Oilseeds Products and Processing F.W. Collins (Chair) E.C.O.R.C. Agriculture and Agri-food Canada K.W. Neatby Building, C.E.F. Ottawa, ON	Phone: (613) 759-1715 Fax: (613) 759-1701 collinsb@em.agr.ca
Ontario Expert Sub-Committee on Meat Products and Processing Pat Johnson (Chair) Food Inspection Branch Ontario Ministry of Agriculture, Food and Rural Affairs 1 Stone Road West Guelph, ON N1G 4Y2	Phone: (519) 826-3667 Fax: (519) 826-4375 pat.johnson@omafra.gov.on.ca
Ontario Expert Sub-Committee on Fruits and Vegetables, Products and Processing Gopi Paliyath (Chair) Department of Food Science University of Guelph Guelph, ON N1G 2W1	Phone: (519) 824-4120 x4856 Fax: (519) 824-6631 gpaliyat@uoguelph.ca
Ontario Expert Sub-Committee on Dairy Products and Processing (vacant)	

APPENDIX C:
University of Guelph/OMAFRA Food Research Program

1. Food Quality and Safety

Methods for early detection, and reduction/elimination of food safety hazards and contaminants:

- Characterization of foodborne pathogens using the RiboPrinter (25560)
- Application of Impedence Technology for the detection and enumeration of *Salmonella spp.* on beef and poultry carcasses (25130)
- Improving the safety of fermented meat products (24710)

"Farm to Fork" Processes for ensuring food safety:

- A systems approach to the evaluation and extension of shelf-life for ready-to-use packaged vegetables (25270)
- Fuzzy and statistical techniques for food safety risk characterization and valuation (24820)
- Role of biofilm formation in the persistence of *Listeria monocytogenes* in food processing environments (25280)
- Process development for lower-fat and better-quality fried foods using edible coatings, and for pan fried meat patties for better safety (24830)

Methods to improve the quality and consumer acceptance of Ontario products:

- Improvement of fluid holding capacity in processed meat (25564)
- Protein- Polysaccharide Interactions in Frozen Systems: effect on ice recrystallization in frozen foods (24570)
- Controlled Atmosphere Storage and Modified Atmosphere Packaging of Fruits (25605)
- Improving structure and properties of fruits, vegetables and processed products by regulating the activities of undesirable and detrimental reactions (24520)
- Process development for lower-fat and better-quality fried foods using edible coatings, and for pan fried meat patties for better safety (24830)
- Preparation of food samples for chemical analysis in health Canada's "The Market Basket Study"(23090)
- A systems approach to the evaluation and extension of shelf-life for ready-to-use packaged vegetables (25270)

On-line methods for monitoring and predicting quality during processing:

- Prediction of changes in chip colour in commercial storage (24540)
- Improvement of fluid holding capacity in processed meat (25564)

2. Value-added Products and Innovative Technologies

Methods to enhance the value of Ontario products:

- Structure and functional properties of anti-freeze proteins isolated from Ontario Winter Wheat (24560)
- Value Added Products from Milkfat (24380)
- Physical and chemical properties of fat globules and casein micelles in milk naturally supplemented with docosahexaenoic acid (omega-3) (25250)
- Immune-supportive functional food activity of flaxseed and canola oils: Indices suitable for human testing, influence of extraction processing, and effectiveness up to advanced age (24880)
- Development of Ontario-Growm Blueberries (Vaccinium species) Yielding Value-Added Nutraceuticals and Functional Foods (24580)
- The Development of Sphingolipids from Milk and Soybeans as Functional Food Ingredients (25530)
- Structure-Functional Studies of Phosphopeptides Derived from Egg Yolk Phosvitin as Nutraceuticals (25603)
- Nutraceuticals in human health and nutrition (24510)

Development of innovative technologies to improve the manufacturing effectiveness of existing food products or to facilitate the production of new food products:

- Developing New Gas Transfer Systems for modified Atmosphere Packaging (25140)
- Pretreatment technology development for the non-solvent extraction of lycopene from tomato skins

(24940)

- Value-Added Product Recovery using Supercritical Fluids (24940)
- Modeling of Supercritical CO2 Fluid Extraction of Lycopene from Tomato by Neural Networks based Methodologies - Optimization of Extraction Technology (25604)

APPENDIX D:
OMAFRA Special Research Program
- New Projects Funded in 2001

Food Safety Risk Assessment and Control

SR0012-FSRA01 Method Validation and Monitoring Survey of Patulin in Ontario Apple Juices and Ciders

Nick Schrier, University of Guelph, Laboratory Services Division, Toxicology Section, Animal Health Laboratory, Guelph, ON

SR0012-FSRA02 Mycobacterium Avium Subspecies Paratuberculosis in the Ontario Dairy Industry: Strategies for Dectection of the Bacterium in Dairy Products
Dr. L. Mutharia, University of Guelph, Department of Microbiology, Guelph, ON

Value-added Food

SR0012-VAFP03 Determination of the Functional (Value-Added) Components of Ontario Produced Soybeans, their Soybean Oils, and By-Products for the Purpose of Developing Value-Added Novel Soy Food Products for the Ontario Food Industry.
Chung-Ja C. Jackson, University of Guelph, Laboratory Services Guelph Centre for Functional Foods, Guelph, ON

SR0012-VAFP05 Nutritional Quality of Organic Spelt Products
Elsayed Abdelaal, Agriculture and Agri-Food Canada, Food Research Program, Guelph, ON

SR0012-VAFP06 In Vivo and In Vitro Characterization of Resistant Starches from Ontario Corns and Corn-Products as Value-Added Functional Food Ingredients
Dr. Qiang Liu, Agriculture & Agri-Food Canada, 93 Stone Road West, Guelph, ON

SR0012-VAFP09 Evaluation of the Biological Activity of Selected Canola Fractions
Dr. Elzbieta M. Kurowska, KGK Synergize, Inc., 130-100 Collip Circle, London, ON

SR0012-VAFP10 The Effect of Ontario-Grown American Ginseng on Blood Pressure Control in Hypertension
Vladimir Vuksan, St. Michael's Hospital, Risk Factor Modification Centre, Toronto, ON

Value-added Non-food

SR0012-NFP02 Bio-Refineries in Ontario: An Investigation of the Potential for Corn-Based Biochemical Manufacturing Facilities in Ontario
Ken Hough, Research Director, Ontario Corn Producer's Association, 90 Woodlawn Road West, Guelph, ON

SR0012-NFP03 Novel Transition Metal Based Catalysts for the Ionic Hydrogenation of Sugar Alcohols to High Value-Added Petrochemical Building Blocks
Marcel Schlaf, University of Guelph, Guelph, ON

SR0012-NFP07 Evaluation of the Economic and Sustainability Implications of a Lignocellulosic Ethanol Industry for Ontario: An Augmented Life Cycle Assessment
Professor Heather L. McAllen, University of Toronto, Department of Civil Engineering, Toronto, ON

Alternate Livestock Species

SR0012-ALS02 Investigation of Epizootic Catarrhal Gastroenteritis (ECG) of Farmed Mink
Dr. Bruce Hunter, University of Guelph, Ontario Veterinary College, Guelph, ON

SR0012-ALS03 Development of Non-Surgical Embryo Transfer Technology for Use in Farmed Elk and Red Deer
Dr. Claire Plante, Therion Research Ltd., RR5, Guelph, ON

Antimicrobial Resistance

SR0012- AMR01 Production of Transgenic Pigs That are More Resistant to Disease
Dr. Julang Li, University of Guelph, , Guelph, ON

SR0012-AMR02 Antimicrobial Resistance in Selected Bacteria of Beef Cattle and Associations with on-farm Antimicrobial Use.
Scott McEwen, University of Guelph, Department of Population Medicine, Guelph, ON

SR0012-AMR04 Novel Saccharide Modifiers of Bacterial Colonization
Dr. M. Anthony Hayes, University of Guelph, Dept. of Pathobiology, Guelph, ON

SR0012-AMR05 Use of Prebiotics and Probiotics as Replacements for Antibiotics in Pig Starter Feeds
Dr. Gregor Reid, Lawson Health Research Institute, 268 Grosvenor Street, London, ON

Healthy Environment

SR0012- ENV06 Livestock & Agricultural Intensification: Community Perceptions of Environmental, Economic & Social Impacts as an Impediment to Agricultural Production
Dr. Wayne Caldwell, University of Guelph, School of Rural Planning and Development, Guelph, ON

SR0012-ENV08 Analytical Profiles of the Livestock Industry in Ontario
Dr. John Fitzgibbon, University of Guelph, , Guelph, ON

SR0012- ENV09 Removal Efficiency of Representative Bacterial and Protozoan Pathogens from Cattle and Pig Farm Wastewater Using Wetland Technologies
Dr. Robin Slawson, University of Waterloo, Office of Research, Waterloo, ON

SR0012-ENV14 The Effect of Nutrient Availability on Biogeochemical Processes Affecting the Transport of *Esherichia Coli* In Soils
Danielle Fortin, University of Ottawa, Department of Earth Science, Ottawa, ON

SR0012-ENV15 The Development of DNA Microarray Technology for Use in Testing of Key Microbial Contaminants in Water Samples
Dr. Shu Chen, University of Guelph, Laboratory Services Division, Guelph, ON

SR0012-ENV10 DNA Fingerprinting Analysis of Escherichia Coli using Repetitive-Element and Toxin Specific Gene Amplification to Differentiate Pollution Sources in the Environment
Michele Van Dyke, GAP EnviroMicrobial Services, 1020 Hargrieve Road, London, ON

SR0012-ENV07 Quantifying Preferential Flow and Recharge at the Field Scale: The First Step in Characterizing the Nature and Timing of Pathogen Transport to Groundwater.
Gary Parkin, University of Guelph, Guelph, ON

SR0012-ENV18 Identification of Critical Regions for Water Quality Monitoring with Respect to Risk of Seasonal and Annual Water Surplus
Dr. C. Wagner-Riddle, University of Guelph, OAC, Land Resource Science, Guelph, ON

Pesticide Reduction and Safe Usage

SR0012-PRSU01 Minor Use Herbicide Registration for Vegetable Crops
Professor John O'Sullivan, University of Guelph, , Guelph, Ontario

SR0012-PRSU07 Root Rots of Ginseng: Identification of Candidate Fungicides for Minor Use Registration and Assessment of Fungicide Resistance
Dr. Richard Reeleder, Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre, London, ON

SR0012-PRSU10 Identify and Develop Strawberries Resistant to Tarnished Plant Bug
Dr. Adam Dale, University of Guelph, Department of Plant Agriculture, Simcoe, ON

SR0012-PRSU11 Management Strategies for the Swede Midge in Ontario Cole Crops
Dr. Rebecca H. Hallett, University of Guelph, Department of Environmental Biology, Guelph, ON

SR0012-PRSU14 Growth Regulation Effects on Apple and Pears for Sustainable Management of Fire Blight (Erwinia Amylovora)
Dr. John A. Cline, University of Guelph, Department of Plant Agriculture, Simcoe, ON

SR0012-PRSU16 Development and Enhancement of Resistance to Varroa Mites in Ontario Honey Bee Stocks
Dr. Medhat Nasr, University of Guelph, Department of Environmental Biology, Guelph, ON

SR0012-PRSU17 Evaluation of a New Insecticide and Alternative Strategies for Effective Control of European Corn Borer with Minimal Impact on Honeybees Foraging in Sweet Corn
Dr. C. D. Scott-Dupree, University of Guelph, Dept. of Environmental Biology, Guelph, ON

SR0012-PRSU22 Integrated Crop Management of Onion White Rot
Dr. Mary Ruth McDonald, University of Guelph, Dept. of Plant Agriculture, Kettleby, ON

SR0012-PRSU20 Studies on the Epidemiology of Erwinia Soft-Rot and Their Control in Ornamental Crops
Dr. Theo J. Blom, University of Guelph, Guelph, ON

APPENDIX E: Food Safety Research Program - New Projects Funded in 2001

1. Application of the Impedance and Colorimetric Systems for Rapid and Cost Effective Detection of Listeria Species in Food and Environmental Samples - *Dr. Joseph Odumeru, University of Guelph, Lab Services Division*

The objective of this project is to assess specific technologies for more rapid and cost-effective detection of *Listeria* spp. in food and environmental samples. One new test should detect the bacteria in food and environmental samples within 24-30 hours of testing, as opposed to 6-7 days of testing by culture. As well, an automated alternative for culturing Listeria species that will allow for testing of a large number of samples (up to 120) simultaneously reducing the cost of environmental monitoring by up to 50%.

2. Improvement and Validation of a DNA Microchip-based Test for Rapid and Simultaneous Detection of Six Food-borne Pathogens in Food Samples - *Dr. Shu Chen, University of Guelph, Lab Services Division*

The objective of Dr. Chen's research is to improve and validate a test that can be implemented in diagnostic labs for the detection of pathogens in food samples. The DNA chip-based test will detect six key food-borne pathogens in a single sample. This will improve the efficiency and effectiveness of laboratories in providing greater services to Ontario's agri-food industries in the area of food safety.

3. Occurrence of Enteric Pathogens and Antimicrobial Resistance Patterns in Selected Retail Poultry Products and Human Cases in a Southwestern Ontario County - *Dr. Scott McEwen, University of Guelph, Population Medicine*

Dr. McEwen will determine the prevalence of *Campylobacter* spp. on retail poultry in a defined geographic area of Ontario. The integration of data on the occurrence and resistance patterns of *Campylobacter* isolated from a representative sample of retail poultry, and all laboratory confirmed human cases of campylobacteriosis, will improve our understanding of the relative contribution of poultry consumption to infection with both susceptible and resistant strains of *Campylobacter*. Dr. McEwen will collaborate with several researchers from Health Canada and the Ontario Ministry of Health and Long-term Care.

4. Johne's Disease - New Test Validation - *Dr. Marie Archambault, University of Guelph, Laboratory Services Division, Animal Health Laboratory*

Dr. Achambault's research will validate a new test for Johne's disease in cattle which will provide rapid and accurate diagnostic confirmation that cattle are infected with *M. paratuberculosis*, the agent of Johne's disease. *M. paratuberculosis* is suspected to be the pathogen that causes human Crohn's disease. It could potentially be spread from infected animals to humans through ingestion of milk (even pasteurized), meat or water. Ontario needs the laboratory capability to culture *M. paratuberculosis* using the new test which offers speed and sensitivity benefits over conventional culture.

5. Development of an Analytical Method for the Confirmation of Sulfonamides in Animal Tissues - *Louise Spilsbury, University of Guelph, Laboratory Services Division*

The result of this project will be the ability to detect the seven sulfonamides designated by OMAFRA as potential antibiotic residues in meat. Currently, there is no test available at the University of Guelph laboratory. Once validated, this test method will be submitted for accreditation under the Standards Council of Canada.

6. Surveillance of Ontario pig farms for diseases of public health significance – *Dr. Robert Friendship, University of Guelph, Department of Population Medicine*

This study will determine the prevalence and risk factors of *Salmonella typhimurium, E. coli, Yersinia enterocolitica, Influenza* and *Toxoplasma gondii* at the Ontario farm level.

By identifying the risk factors associated with the presence of these pathogens, a potential strategy to reduce or eliminate the pathogen form the farm can be devised. In addition, the study will develop /validate an applicable test method for enumeration of *Toxoplasma gondii.*

7. A community trial to determine an effective intervention for the delivery of HACCP to the Food Service Sector – *Dr. Tom Abernathy, McMaster University, Central west Health Planning Information Network and Department of Clinical Epidemiology & Biostatistics*

The objective of Dr. Abernathy project is to evaluate the effectiveness and applicability of a food safety program for the food service industry based on HACCP principles. The intervention to be tested is developed in collaboration and consultation both with public health inspectors and food service managers. The result of this study will be the guideline of how to apply HACCP to the food service industry.

8. Assessing the incidence of antimicrobial resistant *E. coli* and *Salmonella* bacterial isolates in cull cows from Ontario free stall dairy herds – *Dr. David Kelton, University of Guelph, Department of Population Medicine*

The objective of this project is to determine the incidence of antimicrobial resistant *E. coli* and *Salmonella* spp. in cull dairy cows entering the food system as beef. This study will determine if antimicrobial resistance in the Ontario cull dairy cows is a significant food safety issue, and if so, provide some insight as to what risk factors contribute to the development of resistant bacteria in these animals.

9. Development of a rapid, sensitive, and reliable test for the detection and quantification of *Escherichia coli* in foods – *Dr. Stephen Brown, Queen's University, School of Environmental Studies/Centre for Water and Environment*

Dr. Brown's project will develop a rapid, sensitive and reliable method for the detection and quantification of *E. coli* in food and water samples that will be able to provide the test results within 1-2 hours of testing, as opposed to 1-3 days of testing by current methods. In addition, the outcome of the project will be a test kit suitable for easy field use.

10. Campylobacter isolation methodology and molecular characterization – Dr. Scott McEwen, University of Guelph, Department of Population Medicine

Dr. McEwen will carry out molecular sub-typing of a subset of the isolates generated from previous study ('Occurrence of enteric pathogens and antimicrobial resistance patterns in selected retail poultry products and human cases in a southwestern Ontario county' which was funded under round one of the Food Safety Research Program). In addition, a subset of the isolates generated in the retail poultry study will be utilized to evaluate alternative methods for *Campylobacter* enumeration. The ability to quickly and inexpensively conduct enumeration of *Campylobacter* spp. will provide incentive for the inclusion of alternative method in both research and surveillance initiatives.

11. Development of a novel protein chip-based test for rapid and cost-effective *Salmonella* serotyping – *Dr. Shu Chen, University of Guelph, Laboratory Services Division*

Dr. Chen's research will focus on the development of a protein microchip-based technology for rapid, accurate and cost-effective serotyping of *Salmonella* spp. The availability of such test will allow diagnostic labs to provide faster and cost-effective results to food and animal industries in Ontario.

12. Detection of *Campylobacter jejuni* by fluorescent *in situ* hybridization – *Dr. Heidi Schraft, University of Guelph, Department of Food Science*

Dr. Schraft's project is to develop and validate a novel culture independent method to detect *Campylobacter jejuni* in poultry and poultry processing environments. The novel culture independent method will overcome the difficulties associated with culturing while still being specific for viable *C. jejuni*. The new method will support poultry producers and processors in their ongoing efforts of reducing prevalence of the pathogen in the production chain.

13. Development and validation of a screening protocol for identifying sulfamethazine-violative swine carcasses at Ontario abattoirs – *Mark Mitchell and Dr. Louise Spilsbury, University of Guelph, Laboratory Services Division*

The objective of this project is to assess commercial test kits for more rapid and cost-effective detection of sulfamethazine residues in swine urine at abattoirs. One new test should allow the implementation of an effective system for identifying sulfamethazine-violative hog carcasses on-site at the provincial abattoirs.